SUMMARY OF THE INVENTION:

The invention provides a neuron chip platform 100 comprising a charge coupled device detector (CCD) array on a substrate 10, a thin protective film 20 over the CCD array, a thin patterned film 30 to promote neuron growth, and an insulator 50.

The invention further provides a cell potential measurement apparatus 200 comprising (A) an neuron chip platform 100 provided with a charge coupled device detector (CCD) array on a substrate 10, a thin protective film 20 over the CCD array, a thin patterned film 30 to promote neuron growth, and an insulator 50; (B) an illumination source, (C) a stimulation signal supply means 70 for providing electric stimulation to the cells; and (D) a signal or image processing means 80 to be connected to the electric connection means 60 of the neuron chip platform for processing an output signal or image arising from electric physiological activities of the cells.

The present invention comprises a charge coupled detector device (CCD) in electrical contact with a large array of interconnected cells. The CCD should have relatively small pixel size, preferably a pixel size of about 6 microns square (6 x 6) to about 15 microns square, preferably less than 7 microns square. The size of one pixel is preferably on the order of the size of one neuronal cell to be cultured. For signal magnification purposes, it may be preferable that the pixel size be on the order of two pixels are the size of one neuronal cell to be cultured. Larger pixel sizes can also be used to monitor electrical properties among neuronal arrays, that is, along a neuronal path. The CCD comprises standard electronics, including but not limited to silicon gates, a field period readout system, electronic shutter with variable charge-storage time and is referred to as the CCD chip or CCD array 10.

The present invention takes advantage of the ability of a CCD to act as an electrostatic pick-up device. Thus, the electrostatic changes brought about by a single cell propagating a nerve signal through membrane depolarization can be measured and

recorded in real time. Further, the nerve signal can be mapped across an area including a number (on the order of 10^4 to 10^6) of interconnected nerve cells that have been cultured on top of the CCD. Electrical propagation among other types of cells (e.g. cardiac, smooth or striated muscle) could also be studied. In a preferred embodiment, the protective film 20 and the patterned films 30 are preferably made through plasma deposition with a filtered vacuum arc system. The patterned films 30 are preferably diamond like carbon films of about 100 to 150 Å in thickness.

In order to directly transmit the above-described electrical changes, it is important that the CCD array be in electrical contact with the neuronal culture. This is accomplished by the use of thin films applied to the CCD.